Public Workshop
Technology Assessment on Climate Change Emissions
from Light-Duty Vehicles

# Discussion of Results from TIAX Study

**April 20, 2004**

**Sacramento, CA**

California Environmental Protection Agency

**Air Resources Board**

# Alternative Fuel Vehicles

- Impact on climate change emissions

- Well-to-wheels analysis

- Cost and marketability issues

- Technology improvements identified for conventional vehicles not included

California Environmental Protection Agency
**Air Resources Board**

# Alternative Fuels

- Electricity

- Ethanol

- Compressed Natural Gas

- Liquid Petroleum Gas

- Plug-in hybrid

California Environmental Protection Agency

**Air Resources Board**

# Electricity

- Large emissions benefit ~ 50 percent

- Marketability and cost issues

- Small city and neighborhood vehicles more viable but have smaller emission benefits

California Environmental Protection Agency

**Air Resources Board**

# Ethanol

- 35 percent reduction relative to gasoline

- Current flexible fuel vehicles use gasoline due to lack of infrastructure

- Dedicated fuel vehicles necessary to ensure emission benefits

# Compressed Natural Gas

- Emissions benefit ~ 30 percent

- Modest refueling infrastructure

- Home refueling key to larger scale commercialization

# Liquified Petroleum Gas

- 30 percent reduction relative to gasoline

- Fleet use in California:  33,000 vehicles
  – central refueling

- Most cost-effective alternative fuel

California Environmental Protection Agency

**Air Resources Board**

# Plug-in HEV

- ~50 percent reduction relative to gasoline
- 20 - mile all-electric range

# CO$_2$ Comparison

| | Total CO2 g/mile | Lifetime Tons | Percent Reduction |
|---|---|---|---|
| Convention vehicle | 409 | 91 | 0 |
| Electricity | 205 | 48 | -50 |
| Ethanol | 250 | 58 | -36 |
| CNG | 280 | 65 | -28 |
| LPG | 275 | 64 | -29 |
| Plug-in HEV | 195 | 46 | -50 |

# Incremental Cost

| | Cost Increment | Lifetime NPV |
|---|---|---|
| Convention vehicle | $0 | $0 |
| Ethanol | $0 | ($2,412) |
| CNG | $3,600 | ($6,039) |
| LPG | $700 | ($3,342) |
| Plug-in HEV | $5,700 | $691 |

# Adjustment Factors

| Fuel | CO2 Adjustment Factor |
|---|---|
| Emissions | |
| CNG | 1.03 |
| LPG | 0.89 |
| E85, Corn | 0.76 |
| Fuels with no direct CO2 Emissions | |
| Electricity, Grid NG | 643 g/kWh |
| | |

# Staff Conclusions

- Alternative fueled vehicles available in limited quantities
- Substantial reductions in climate change emissions possible from wider use
- Incremental costs and fuel availability hurdles to commercialization

California Environmental Protection Agency

**Air Resources Board**